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ABSTRACT

As part of an evaluation of the Missouri master plan for higher education, employment and manpower trends in the state are examined. A summary of the state historical employment trends in the primary occupational sectors is presented. Included is an analysis of the 10-year trends from calendar year 1972 through the first quarter of calendar year 1983. Also included are comparisons of the changes by occupational sector from calendar years 1972 to 1982, and a summary of the projected nationwide trends in these occupational sectors through 1990. It is shown that the increase in the number employed in Missouri in the last decade was due entirely to an increase in employment in the nonmanufacturing economic sector; overall employment in the manufacturing sector actually decreased during the time. Staffing patterns within these sectors are also analyzed with regard to the percentage of college-educated employees, and attention is directed to the relationship of these percentages to the employment trends. Potential occupational opportunities in the high technology industries are addressed, with emphasis on the relationship of these possibilities to the future role of higher education. Directions that higher education might consider in assuming this role are highlighted. (SW)

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MISSOURI MANPOWER TRENDS

MASTER PLAN III ASSESSMENT
PROJECT REPORT NUMBER FOUR

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MISSOURI COORDINATING BOARD FOR HIGHER EDUCATION

JUNE 1983

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Southwest Missouri State University
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Moberly Area Junior College

St. Louis Community College
- St. Louis Community College at Florissant Valley
- St. Louis Community College at Forest Park
- St. Louis Community College at Meramec

State Fair Community College

Three Rivers Community College

Trenton Junior College

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Foreword

The steady decline in state and federal support of higher education prompted the Missouri Coordinating Board for Higher Education in December 1981 to direct its staff to evaluate the State Master Plan for Higher Education, **Master Plan III**, published in 1978.

The Master Plan III Assessment Project was organized to describe major trends in Missouri over the past several years and the implications of these trends for higher education; to project the trends for the future and their implications for higher education in Missouri; and to specify a range of public policy alternatives available to the educational and political decision makers who hold the responsibility for higher education.

The issues of access, diversity, and funding comprise the major areas of study for the Master Plan III Assessment Project and are the issues for which public policy alternatives will be developed. This report is the fourth descriptive report on the trends in Missouri higher education.

Shaila R. Aery
Commissioner of Higher Education

Introduction

The following report, the fourth in the assessment of **Master Plan III for Postsecondary Education in Missouri,** focuses upon employment and manpower trends. This study was undertaken because of the relationship between higher education and the demand for a literate and well-trained labor force, a relationship that will undoubtedly become even more important as the industrial base of Missouri is expanded with the influx of high technology and service-oriented industries.

The report first presents a summary of the state historical employment trends in the primary occupational sectors. Included is an analysis of the ten-year trends from calendar year 1972 through the first quarter of calendar year 1983. Also included are comparisons of the changes by occupational sector from calendar years 1972 to 1982, and a summary of the projected nationwide trends in these occupational sectors through 1990. It is shown in this section that the increase in the number employed in Missouri in the last decade was due entirely to an increase in employment in the nonmanufacturing economic sector; overall employment in the manufacturing sector actually decreased during this time. If the current pattern of employment in Missouri remains relatively consistent through 1990, projections show a moderate increase in the manufacturing areas, with a larger increase in the nonmanufacturing areas.

The second part of the report analyzes the staffing patterns within these sectors with regard to the percentage of college-educated employees. This section also focuses upon the relationship of these percentages to the employment trends. It is concluded in this section that the areas which have experienced the highest growth in employment over the last decade are those that appear to have the largest percentages of college-trained personnel. In contrast, for the most part, the industries that have experienced the greatest decline in the number employed appear to have required smaller percentages of college-trained personnel.

The third part of the report focuses upon potential occupational opportunities in the high technology industries, emphasizing the relationship of these possibilities to the role of higher education in the future. Highlighted in this section are some directions that higher education might consider in assuming this role. It is pointed out in this section that between 1970 and 1980 the demand for professional, technical, managerial, clerical and sales positions increased by 30 percent, while the employment of production and maintenance workers increased by only 7.8 percent. It is concluded that this trend will continue and perhaps accelerate as the impact of the high technology industries upon employment increases, requiring higher education to look at new and innovative approaches. Such innovation may become especially critical in a period of reduced governmental support.

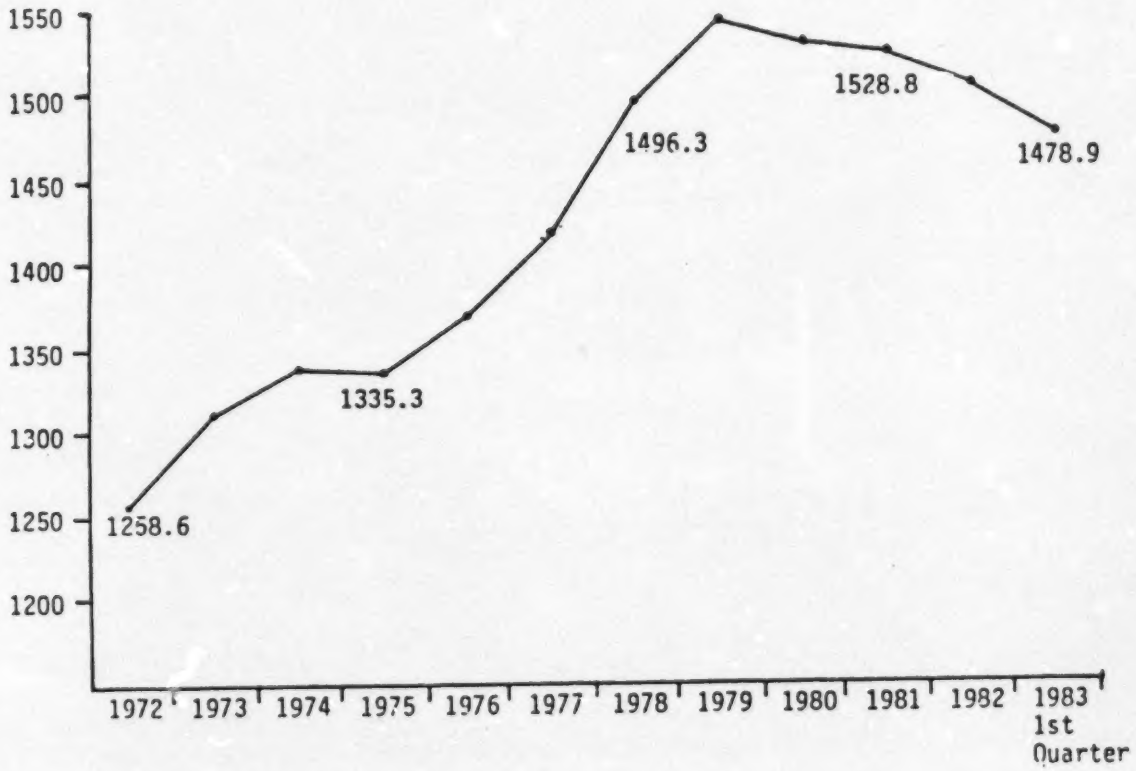
Historical and Current Employment Trends in the Primary Occupational Sectors in Missouri

From calendar year 1972 through 1982, there was a relatively steady increase in nonagricultural employment in Missouri. The overall increase during this time period was 216,100 employed people, or 12.7 percent.[1] Due to the recession, total employment dropped from 1.92 million in calendar year 1982 to 1.87 million during the first quarter of calendar year 1983.

The increase in total employment during the ten year period was due to an increase in the nonmanufacturing sector, as shown in Display #1. This sector had a 19.9 percent increase in employment, from a calendar year 1972 average of 1,258,600 to an average of 1,508,900 in calendar year 1982. The first quarter of 1983 showed a decline of 30,000 to 1,478,900, again, due to the recession.

Displays #2 and #3 further show that within the nonmanufacturing sector, the service industries showed the greatest change, with employment increasing by 46.9 percent from 1972 through 1982.

DISPLAY #1
TOTAL EMPLOYMENT IN THE NONMANUFACTURING SECTOR IN MISSOURI
1972 - 1ST QUARTER 1983
(IN THOUSANDS)

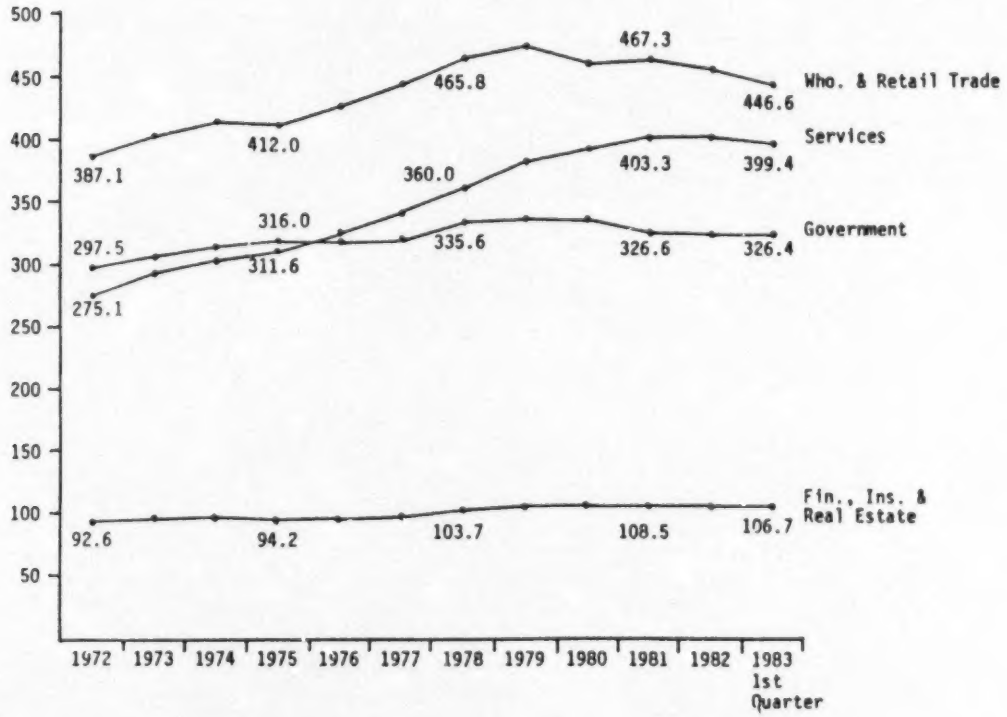


DISPLAY #2. COMPARISON OF EMPLOYMENT IN THE NONMANUFACTURING INDUSTRIES IN MISSOURI 1972 - 1982 (EMPLOYMENT IN THOUSANDS)

Industry	Year 1972	1982	Difference	Percentage Difference
Mining	8.7	7.1	(1.6)	(18.4)
Contract Construction	72.8	74.3	1.5	2.1
Transportation and Public Utilities	124.8	131.5	6.7	5.4
Wholesale and Retail Trade	387.1	459.0	71.9	18.6
Finance, Insurance and Real Estate	92.6	108.4	15.8	17.1
Services	275.1	404.2	129.1	46.9
Government				
Federal	68.6	67.0	(1.6)	(2.3)
State and Local	228.9	257.4	28.5	12.5
TOTAL NONMANUFACTURING	**1,258.6**	**1,508.9**	**250.3**	**19.9**

Source: Bureau of Labor Statistics, Report on Employment, 1972 through 1982

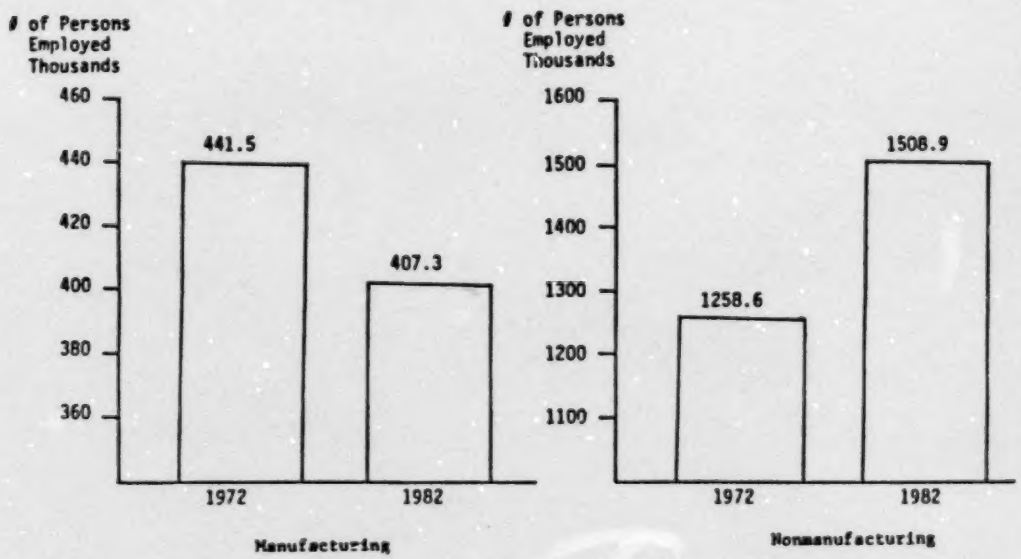
DISPLAY #3
EMPLOYMENT IN SELECTED NONMANUFACTURING INDUSTRIES IN MISSOURI
1972 - 1ST QUARTER 1983
(IN THOUSANDS)



Employment in the wholesale and retail trade and the finance, insurance and real estate industries also showed large increases. Other industries showing increases were transportation and public utilities and contract construction. The overall increase in government employment was 9.0 percent. Employment in state and local government in Missouri increased by 12.5 percent during this time, while the number of federal employees in the state actually decreased by 2.3 percent. The mining industries also experienced a relatively large decrease during this time.

As shown in Display #4, the increases in employment in the nonmanufacturing sector in Missouri were countered by a substantial decrease in employment in the manufacturing sector. This sector had a decrease in the number of employed from 441,500 in calendar year 1972 to 407,300 in calendar year 1982. There was a further drop to 395,000 in the first quarter of calendar year 1983.

DISPLAY #4
COMPARISON OF NUMBER EMPLOYED IN MANUFACTURING AND NONMANUFACTURING INDUSTRIES IN MISSOURI, 1972 - 1982



As shown by Display #5 and #6, both the durable goods and nondurable goods areas showed decreases in employment over this time period. In fact, the respective percentage decreases were nearly equal. Within the durable goods area, employment in the fabricated metal products industries showed the greatest percentage decrease. The stone, clay and glass products industries and the lumber and wood products industries had nearly as large decreases. The transportation and equipment industries, which employ the most people in the durable goods area, also showed a large drop. Showing only small decreases in employment over this time period were the primary metal industries and the furniture and fixture industries. Two areas registered increases in employment; they are the instruments and related products industries, which increased employment by 103 percent and the electrical and electronic equipment industries, which increased employment by 3.7 percent. There was also an increase of 17.8 percent in the miscellaneous manufacturing industries over this time period.

In the nondurable goods area, the largest percentage decrease in employment, 27.1 percent, was in the apparel and textile mill products industries. The leather and leather products and the food and kindred products industries also experienced large decreases. The printing and publishing industries, chemical and allied products industries, and other nondurable goods industries showed increases in employment during this time period.

Display #7, presents a graphic comparison of employment in selected durable goods industries. Display #8, presents a graphic comparison of employment in selected nondurable goods industries.

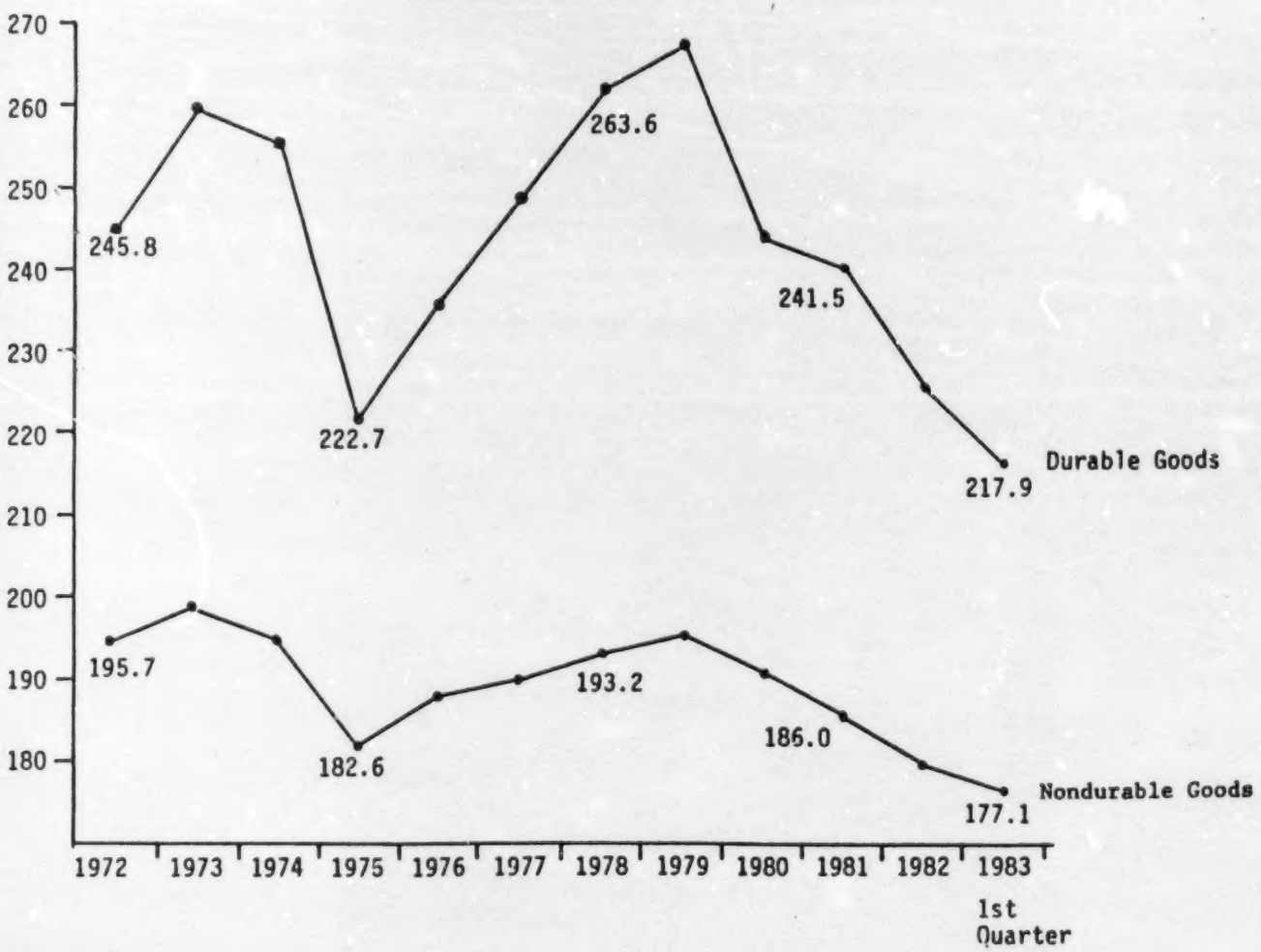
DISPLAY #5. COMPARISON OF EMPLOYMENT IN THE MANUFACTURING SECTOR IN MISSOURI, 1972 - 1982 (EMPLOYMENT IN THOUSANDS)

Industry	Year 1972	1982	Difference	Percentage Difference
Durable Goods:				
Lumber and Wood Products	10.6	8.5	(2.1)	(19.8)
Furniture and Fixtures	8.4	8.3	(.1)	(1.2)
Stone, Clay and Glass Products	13.1	10.4	(2.7)	(20.6)
Primary Metal Industries	13.9	13.5	(.4)	(2.9)
Fabricated Metal Products	35.3	27.6	(7.7)	(21.8)
Machinery, Except Electrical	33.2	33.2	-0-	0.0
Electric and Electronic Equipment	45.6	47.3	1.7	3.7
Transportation and Equipment	70.8	58.7	(12.1)	(17.1)
Instruments and Related Products	5.9	12.0	6.1	103.4
Miscellaneous Manufacturing Industries	9.0	7.4	(1.6)	17.8
Total Durable Goods	245.8	226.9	(18.9)	(7.7)
Nondurable Goods:				
Food and Kindred Products	50.2	45.1	(5.1)	(10.2)
Textile Mill Products	2.0*	25.5	(9.5)	(27.1)
Apparel and Other Textile Products	33.0*			
Paper and Allied Products	13.5	12.3	(1.2)	(8.9)
Printing and Publishing	33.4	37.1	3.7	11.1
Chemicals and Allied Products	25.6	28.4	2.8	10.9
Leather and Leather Products	26.6	20.2	(6.4)	(24.1)
Other Nondurable Goods	11.4	11.8	.4	3.5
Total Nondurable Goods	195.7	180.4	(15.3)	(7.8)
TOTAL MANUFACTURING	**441.5**	**407.3**	**(34.2)**	**(7.8)**

Source: Bureau of Labor Statistics, Report on Employment, 1972 through 1982

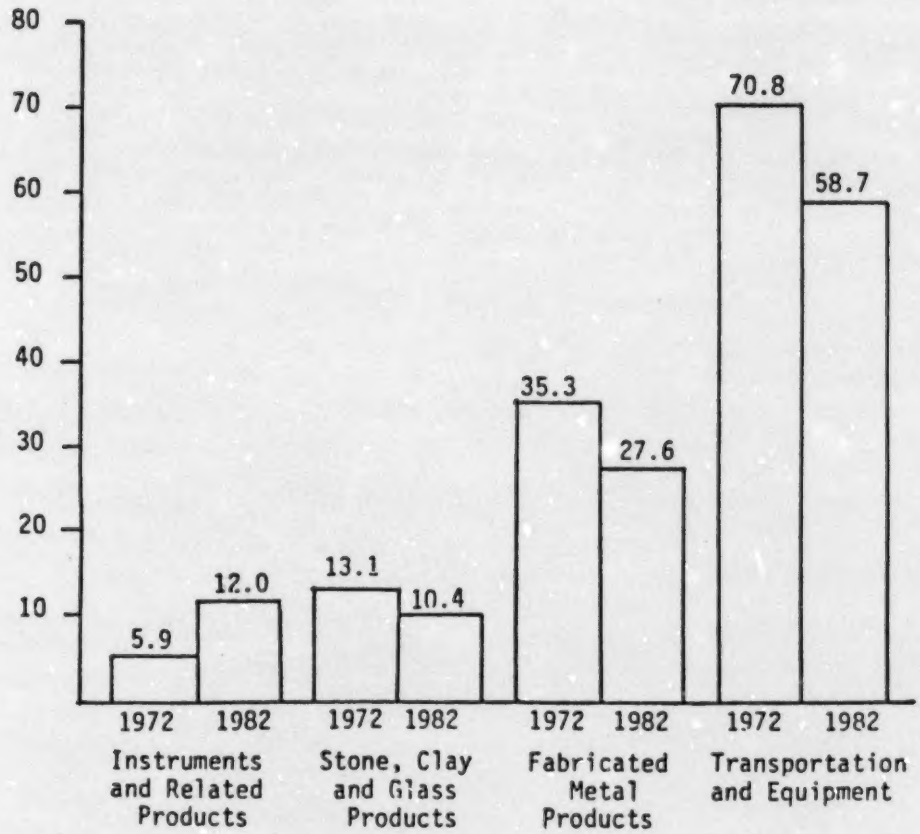
*These industries were combined in Fiscal Year 1982

DISPLAY #6
EMPLOYMENT IN THE DURABLE AND NONDURABLE GOODS INDUSTRIES
IN MISSOURI, 1972 - 1ST QUARTER 1983
(IN THOUSANDS)

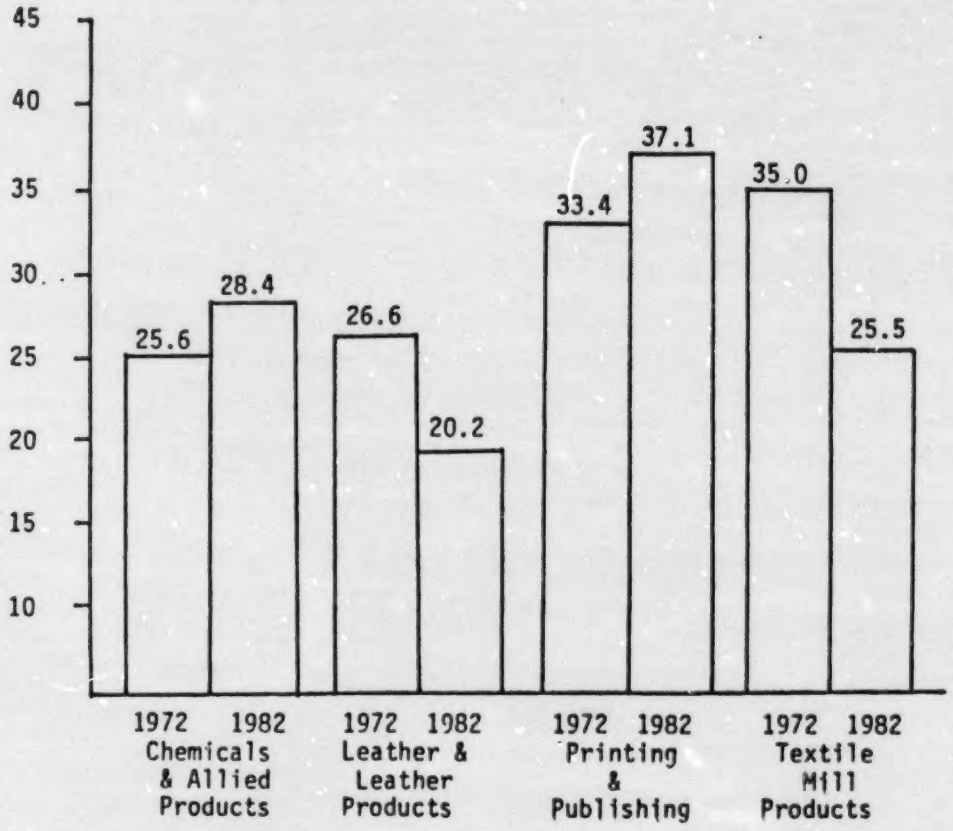


-7-

DISPLAY #7
COMPARISON OF NUMBER EMPLOYED IN SELECTED DURABLE GOODS MANUFACTURING INDUSTRIES IN MISSOURI, 1972 - 1982
(IN THOUSANDS)



DISPLAY #8
COMPARISON OF NUMBER EMPLOYED IN SELECTED NONDURABLE GOODS MANUFACTURING INDUSTRIES IN MISSOURI, 1972 - 1982
(IN THOUSANDS)



National Employment Trends and Projections through 1990; Comparison to Statewide Trends

As Display #9 shows, the nation as a whole also experienced a drop in manufacturing employment from calendar year 1972 through 1982, although the 1.6 percent decrease was not as severe as the 7.8 percent decrease experienced by Missouri during this time. The decrease in national employment in the manufacturing sector was due to a decrease in employment in the nondurable goods area; there was a slight increase in employment in the durable goods area.

Nationwide employment in the nonmanufacturing sector had a greater increase, 29.8 percent, than did Missouri, 19.9 percent, for the period of 1972 through 1982. The increase was greater in all areas, the largest percentage difference being in the mining industries; here, the nation as a whole experienced a 78.5 percent increase, while Missouri experienced an 18.4 percent decline. The differences were not as great in other industries, such as the service and wholesale and retail trade industries; here the growths in nationwide employment were respectively only 7.9 percent and 10.3 percent higher than that in Missouri. In other industries, such as finance, insurance and real estate and government, both Missouri and the nation as a whole experienced large increases. In each case, however, the percentage rate of growth in Missouri was well below that of the national rate of growth.

DISPLAY #9. COMPARISON OF NATIONAL NONAGRICULTURAL EMPLOYMENT TO THAT OF MISSOURI, 1972 - 1982 (EMPLOYMENT IN THOUSANDS)

	United States				Missouri			
	1972	1982	Diff.	% Diff.	1972	1982	Diff.	% Diff.
Total Manufacturing:	19,151	18,848	(303)	(1.6)	441.5	407.3	(34.2)	(7.8)
Durable Goods	11,049	11,112	63	0.6	245.8	226.9	(18.9)	(7.7)
Nondurable Goods	8,102	7,736	(366)	(4.5)	195.7	180.4	(15.3)	(7.8)
Total Nonmanufacturing:	54,525	70,782	16,257	29.8	1,258.6	1,508.9	250.3	19.9
Mining	628	1,121	493	78.5	8.7	7.1	(1.6)	(18.4)
Construction	3,889	3,913	24	0.6	72.8	74.3	1.5	2.1
Transportation and Public Util.	4,541	5,058	517	11.4	124.8	131.5	6.7	5.4
Wholesale and Retail Trade	15,949	20,551	4,602	28.9	387.1	459.0	71.9	18.6
Finance, Insurance and Real Estate	3,908	5,350	1,442	36.9	92.6	108.4	15.8	17.1
Services	12,276	19,001	6,725	54.8	275.1	404.2	129.1	46.9
Government	13,334	15,788	2,454	18.4	297.5	324.4	26.9	9.1
Federal	2,684	2,739	55	2.1	68.6	67.0	(1.6)	(2.3)
State and Local	10,649	13,050	2,401	22.6	228.9	257.4	28.5	12.5
TOTAL NONAGRL EMPLOYMENT:	73,676	89,630	15,954	21.7	1,700.1	1,916.2	216.1	12.7

Projections formulated by the Bureau of Labor Statistics predict that nationwide employment will increase in all sectors, including manufacturing, through 1990. As Display #10 below shows, percentage increases are expected to be greatest in the durable goods manufacturing, construction, services, wholesale and retail trade, and finance, insurance and real estate industries. Overall, nationwide employment is anticipated to increase by 27.9 percent through 1990.

DISPLAY #10. COMPARISON OF CURRENT TO PROJECTED NATIONWIDE NON-AGRICULTURAL EMPLOYMENT 1982 - 1990 (EMPLOYMENT IN THOUSANDS)

Sector Industry	Year 1982	1990	Difference	Percentage Difference
Total Manufacturing	18,848	23,881	5,033	26.7
Durable Goods	11,112	14,692	3,580	32.2
Nondurable Goods	7,736	9,189	1,453	18.8
Total Nonmanufacturing	70,782	90,792	20,010	28.3
Mining	1,121	1,072	(49)	(4.4)
Contract Construction	3,913	5,748	1,835	46.9
Transportation and Public Utilities	5,058	5,658	600	11.9
Wholesale and Retail Trade	20,551	27,370	6,819	33.2
Finance, Insurance and Real Estate	5,350	6,695	1,345	25.1
Services	19,001	26,742	7,741	40.7
Government	15,788	17,507	1,719	10.9
Federal	2,739	N/A	N/A	N/A
State and Local	13,050	N/A	N/A	N/A
TOTAL NONAGRICULTURAL EMPLOYMENT	**89,630**	**114,673**	**25,043**	**27.9**

Source of Projections: Bureau of Labor Statistics, Industry Output and Employments: BLS Projections to 1990

If the current pattern of employment in Missouri remains consistent through 1990, then a moderate increase in employment in the nondurable goods manufacturing areas is anticipated, with larger increases in the durable goods and in the nonmanufacturing areas expected. As with the nation as a whole, the largest increases should appear in the construction, wholesale and retail trades, finance, insurance and real estate, and service industries.

Staffing Pattern - Percentage of College-Educated Employees

In order to determine the impact of the above employment data upon higher education in Missouri, it is also necessary to have an estimate of the percentage of employees in an industry or sector that receive their training in a college or university. To do this, the distribution of workers by job classification, or staffing pattern, for the various industries for Missouri was analyzed using data supplied by the Missouri Division of Employment Security. To develop estimates of the percentages of college-trained personnel in each industry, an assumption was made that all of the professional and technical employees in an industry had some college training. It was also assumed that a segment of the managerial and sales representative staff was college-educated. The percentages used were 50 to 100 percent, depending upon the type of industry. A cumulative percentage was then determined for those industries for which data was available.

From Display #11, it can be seen that, in the manufactured goods sector, chemicals and allied products appear to have the highest percentage of college-educated personnel, with 41.4 percent. This industry also had an increase of 10.9 percent in employment from 1972 through 1982. (See Display #5, page 6.) The instruments and related products industries, which had the largest percentage increase in employment of any manufacturing industry, 103.0 percent, also is estimated to have the third-highest percentage of college-educated personnel, 13.2 percent. The industries that experienced the largest percentage decreases in employment, the textile and apparel industries with 27.1 percent decrease and the leather and leather products industries with 24.1 percent decrease, were among the industries with the smallest percentages of college-trained personnel, both with percentages of 4.9.

DISPLAY #11. ESTIMATED PERCENTAGE OF COLLEGE-TRAINED PERSONNEL EMPLOYED IN THE MANUFACTURING INDUSTRIES IN MISSOURI

Industry	Estimated Percentage College-Trained Employees
Durable Goods:	
Lumber and Woods Products	6.7
Furniture and Fixtures	9.9
Stone, Clay and Glass Products	7.3
Primary Metal Industries	9.5
Fabricated Metal Products	9.8
Machinery, Except Electrical	11.0
Electric and Electronic Equipment	10.6
Transportation and Equipment	N/A
Instruments and Related Products	13.2
Miscellaneous Manufacturing Industries	8.5
Nondurable Goods:	
Food and Kindred Products	4.5
Textile Mill Products	N/A
Apparel and Other Textile Products	4.9
Paper and Allied Products	8.2
Printing and Publishing	18.2
Chemicals and Allied Products	41.4
Leather and Leather Products	4.9
Other Nondurable Goods	N/A

Source: Missouri Division of Employment Security, "Missouri Occupational Staffing Patterns for Manufacturing"

In the nonmanufacturing sector, it can be seen from Display #12 that many of the service industries, which had a growth in employment of 46.9 percent, also are areas that appear to have a large percentage of college-trained personnel. The finance, insurance, and real estate industries and state and local governments, which both experienced relatively large growths in employment (17.1 percent and 12.5 percent) also employ a high proportion of college-trained persons. From this it can be concluded that, for the most part, the industries that have experienced the greatest declines in employment have required smaller percentages of college-trained personnel. The high growth areas, on the other hand, have tended to require the largest percentages of college-trained employees. If the trends continue through 1990, and if the high technology industries expand as anticipated, then the demand upon higher education to educate the labor force may be increasing.

DISPLAY #12. ESTIMATED PERCENTAGE OF COLLEGE-TRAINED PERSONNEL EMPLOYED IN VARIOUS NONMANUFACTURING INDUSTRIES IN MISSOURI

Industry	Estimated Percentage College - Trained Employees
Mining	11.8
Contract Construction	N/A
Transportation and Public Utilities	N/A
Wholesale and Retail Trade	11.6
Finance, Insurance and Real Estate	21.5
Selected Services:*	
Funeral Services and Crematories	29.3
Credit Reporting, Adjustment and Collection	11.4
Services to Dwellings and Other Buildings	3.0
Personnel Supply Services	22.8
Automotive Rental and Leasing	11.3
Motion Pictures	13.6
Miscellaneous Amusement and Recreation	11.2
Nursing and Personal Care	20.3
Out Patient Care Facilities	58.5
Health and Allied Services	58.2
Individual and Family Social Services	35.1
Job Training and Vocational Rehabilitation	30.5
Child Day Care Services	41.4
Residential Care	21.8
Social Services	25.9
Membership Organizations	29.3
Civic, Social and Fraternal Associations	23.9
Membership Organizations	21.5
Engineering, Architectural and Surveying Services	75.8
Accounting, Auditing and Bookkeeping Services	61.4
Government	
Federal	31.3
State and Local	25.2

*The service industries comprise 19 of the 97 Standard Industrial Classifications: Staffing Pattern Surveys were not available for all areas.

Source: Missouri Division of Employment Security, "Missouri Occupational Staffing Patterns for Non-Manufacturing"

Future Demands

This projected demand upon higher education appears to be supported by the current literature in the area. For example, it has been found that the nationwide percentage of professional, technical, managerial, clerical and sales positions increased by 30 percent between 1970 and 1980, while the employment of production and maintenance workers increased by only 7.8 percent.[2] During this time, the number of professional and technical workers rose by more than 4 million - the number of engineering and science technician positions increased by 265,000; the number of accounting positions increased by 335,000 and the number of computer specialists, mainly programmers and analysts, increased by more than 500,000 by 1980.[3] The demand for psychologists and economists more than doubled during this time, as did the demand for authors, speech writers and television writers.

Reflected in these increases is a marked shift toward the development and manufacture of high technology[4] goods and services. It is estimated that this relatively new area contributed about 8.1 percent of the Gross National Product in 1980, or about 25 percent more than they had a decade before.[5] While there is some disagreement as to the number of new jobs they will create in the next decade, two major characteristics of the high technology industries point toward the direction of increased demand for a workforce that has training beyond the secondary school level. The first is the tendency for high technology industries to be well above the average of all industries in their expenditures for research and development. For example, in 1980, 23.2 percent of the value added in the high technology industries was spent on research and development, as compared to 7.2 percent for all manufacturing industries.[6] This fact leads to a technologically intensive labor force of engineers and technicians. It has been predicted, nationally, that the high technology industries will need an additional 221,000 engineers and science technicians between now and 1993. Also needed will be 150,000 managers and clerical workers, and 33,000 other professionals.[7]

Perhaps even more important to this projected demand for highly trained workers is the potential impact that high technology will have upon more conventional industries - especially in increasing the level of sophistication in the technologies of the manufacturing and service industries. It is anticipated that innovations developed for and through high technology will be absorbed into these industries in order to make them more productive and competitive. This impact will likely lead to a demand for a labor force that is able to handle the technological innovations as well as have the ability to think logically and quickly. For example, General Motors forecasts that, by the year 2000, more than half of its work force will be skilled tradesmen

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[4]Generally included as high technology industries are the manufacturers of computers, communications equipment, scientific, measuring, optical and medical instruments, and bio-genetic engineering.

trained for their jobs in this new technology.[8] Industry forecasts predict that there will be a great demand for workers proficient in such skills as laser technology, energy and hazardous-waste management, and materials utilization and genetic engineering, all of which will require technical training, as well as a broad knowledge of other fields. In fact, it is already apparent to some that the skills to "maintain high-technology systems are becoming as important as the creative skills that design the systems."[9] The technology is already moving beyond the abilities of those with traditional training, and "all across the country, buses, planes, utilities, even sewage treatment plants, miracles of modern science are breaking down and proving unusable because we are unable to provide the companion miracle of modern maintenance."[10] Certainly, modern industry cannot maintain an effective level of productivity unless its workforce is sufficiently skilled to meet such challenges.

The obvious impact of these conditions upon the educational system is a growing demand for technical training that is also broadly based. yet it has been pointed out that schools and colleges are "responding too slowly to the central role they must play in revitilizing the American economy. Basic labor-market information is weak. Linkages between education, training systems, and employers are weak. Facilities and equipment are becoming obsolete. Well-trained faculty in key areas such as engineering are scarce."[11] This scarcity is approaching a critical point, as 1,583 teaching positions were vacant in the 244 accredited departments of engineering across the nation during the 1980-1981 scholastic year. This overall shortage is estimated to be between 10 and 15 percent of the total full-time faculty pool.[12]

One probable reason for this shortage of qualified teachers is that academic salaries in these fields are not competitive with business and industry. A professor of computer science can earn anywhere from 25 to 100 percent more in industry.[13] To exacerbate this problem even further, the number of engineering graduate students at the master's and doctoral level is declining. The number of master's degrees granted in 1980 had declined by 10 percent from the 1970 total, and the number of electrical engineering PhD's by 40 percent.[14] As most faculty members are drawn from the ranks of doctoral graduates, the ultimate effect of these declines will be to reduce the pool of faculty who will train the next generation of researchers.

Related to this concern is the declining level of support from the federal government. While this support currently represents only 10 percent of the total support, it is the major source of funding for research and development, and there are few alternative sources to maintain levels. The 100 leading research universities, which grant more than half of all graduate degrees in science and engineering, derive almost 70 percent of their research and development funds, and between one-third and one-fifth of their general revenues, from federal sources.[15] Of the $5 billion spent on research and development in science and engineering by all universities in 1979, 66 percent were federal monies. State and local government accounted for 9 percent of the total, while less than $200 million, or 3.7 percent, was supplied by industry.

How do these concerns affect higher education in Missouri? As the state continues in its efforts to attract high technology industries, the condition of the colleges and universities of the state will definitely be a factor. Certainly, the current trend toward decreasing the levels of constant dollar general revenue for higher education in Missouri places fiscal restraints on the public institutions. These restraints make it progressively more difficult to attract and keep the requisite pool of qualified faculty in the science, math, engineering and other related areas. In addition, maintaining a viable technical training program requires a significant investment in laboratory facilities and equipment as well as stipends and financial assistance adequate enough to attract graduate students.

Under such conditions, public higher education may be faced with difficult choices. For instance, will each college or university be committed and able to maintain a first-rate curricula to support high technology? If so, will the general public and legislature be willing to pay the cost for this, or will the money be found by shifting resources from other areas? Also, will the institutions see these changes as opportunities for developing creative and innovative approaches to handling the changes? For example, it has been suggested that the demands of high technology could "forge a new partnership among federal, state, local, and private interests."[16] Such cooperative efforts might emphasize matching grants for non-federal initiatives - not just from state governments but also from the high technology industries themselves. The industries and universities working together would play a major role in determining where investments in education should be made. Industrial contributions would then trigger grants from both state and federal governments.

Several states, including Missouri, have taken action, or have legislation pending that would emphasize such cooperation. Michigan has actually implemented a research and problem-solving organization that is "concerned with the technical, economic and social aspects of the factory-of-the future technology"[17] and will be interacting directly with industrial companies, universities and colleges, government, labor, and other concerned organizations. A related approach has been introduced in the Missouri legislature as Senate Bill 202. The bill, which has been passed by the Senate, would establish the Missouri Corporation for Science and Technology. This corporation would consist of a board of 18 persons, selected from education, industry, labor, and the general public. Included in their responsibilities would be the identification of areas where scientific research is needed and the pursuit of money from various sources to develop related research activities. The corporation would also assist the state universities and colleges and private industry in coordinating research activities by advising the college and universities on the research needs of private industry and by assisting in the establishment of programs in scientific education.

Other related activities undertaken by Missouri include the proposed Higher Education Research Assistance Act (HB 1375). Under this bill, state public institutions are eligible for grants that allow for comparative research between the universities and private industries; $1.5 million has been appropriated by the General Assembly to fund the measure. In Fiscal Year 1982, the legislature also appropriated $1.4 million for two grants to the

University of Missouri-Kansas City for research in genetic engineering. In addition, a proposal has been made to establish a commercialization center in the College of Business and Public Administration at the University of Missouri-Columbia. The center would serve as a focal point to attract high technology industries to the area as well as to provide students with entrepreneurial learning experiences and faculty with applied research and consulting opportunities.

Conclusion

Data shows that employment in Missouri is shifting from traditional manufacturing industries to industries that reflect the changing economic focus of the nation as a whole. These include an increase in trade and service industries that, on the average, require a larger percentage of college-trained personnel than was the case in the traditional manufacturing industries. Also, Missouri, like the nation as a whole, is committed to developing a high-technological industrial base. In both cases, the need for public higher education to strengthen the curricula that emphasizes the changing labor market is apparent. Given the current fiscal realities, only an innovative and realistic approach will give higher education the flexibility it needs to confront and handle these changes in a positive manner.

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2. Carol Bond Leon, "Occupational Winners and Losers", **American Demographic**, March 1983, page 31.

3. Ibid, page 31-32.

4. See page 15 of Report.

5. Leslie Goldwater, "Can Hi-Tech Turn Us Around?", **Iron Age**, April 13, 1983, page 47.

6. Ibid.

7. "American Rushes to High Tech for Growth", **Business Week**, March 28, 1983, page 87.

8. Marvin Cetron and Thomas O'Toole, "Careers With a Future Where the Jobs Will Be in the 1990's", **The Futurist**, June 1982, page 17.

9. John Naisbitt, **Megatrends**, Warner Books, New York, 1982, page 49.

10 Ibid, pages 49-50

11. From a report entitled "America's Competitive Challenge: The Need for a National Response", issued by the Business - Higher Education Forum, and summarized in **The Chronicle of Higher Education**, May 18, 1983, page 10.

12. James Botlvin, Dan Dimaneeseu, and Ray Stata, "High Technology, Higher Education and High Anxiety", **Technology Review**, October, 1982, page 51.

13. Ibid.

14. Ibid, page 52.

15. Ibid, page 53.

16. Ibid, page 56.

17. Report No. 10, The Program for the Industrial Technology Institute, August 23, 1982, pages ii, iii.